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April 13, 2004

Mr. Chris Adair
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Re: Lower Little Creek Harvest Plan (THP No. 1-04-053 SCR)

Mr. Adair,

We all have been engrossed in discussions over the monitoring expectations for THPs. One benefit is that there has been considerable dialogue among agencies, the timber industry, and the environmental community to address the need, the means, and the merit of monitoring. There have been inconsistencies in monitoring expectations between different THPs, particularly with respect to turbidity monitoring. To a degree this is understandable given the lack of study that specifically addresses the scientific validity of turbidity monitoring. Proposals are currently submitted that will help address these questions. For now we recognize that we have a common desire to see timber harvest practices that offer sound protection for all watershed resources. I understand the issues both for and against turbidity monitoring requirements for THPs and have been following the discussions for a number of years. The Board and scientific staff desire, as we all do, to identify monitoring strategies that are both feasible (economically and physically) and meaningful. Clearly there is more agreement among the hydrologists that have recently commented on the merits of THP monitoring that ground-based monitoring strategies allow for problems to be more confidently identified and thereby more effectively addressed before becoming worse. Turbidity monitoring on the other hand, particularly above and below harvests, will likely fail to identify sediment-related problems during or following events, and lessen the likelihood of identifying and treating the source.

Monitoring of turbidity as an indicator of mass wasting or other surface erosion that is attributable to improper land management practices is possible, yet the methods necessary to detect cause and effect require years of costly data collection using sophisticated equipment and training personnel in laboratory analyses and field instrument operation during often extreme conditions. It is difficult to be successful in collection of all of the parameters necessary for determining event-based sediment responses without a significant commitment of resources and personnel.

A decision to forego turbidity monitoring in lieu of more forensic ground-based monitoring methods is both reasonable and justifiable. There is no evidence that turbidity monitoring above and below THPs can be successful in determining cause and effect without the benefit of high-frequency sampling over extended pre-and post-treatment periods. Even under the most controlled experimental settings, successful calibrations between stations are not guaranteed. Those suggesting the use of instream turbidimeters to monitor turbidity levels on a near-continuous basis must understand the vigilance necessary to maintain consistent operation in stream environments and the need for routine calibration with physical samples.

One of the most compelling reasons to forego turbidity monitoring is the amount of variability that occurs in the event-based sediment response at-a-station and between stations during many stormflow events. The variability is often significant and can be attributed to factors such as storm characteristics and antecedent soil moisture conditions as well as the hydraulic conditions influenced by channel characteristics. Much of this variability illustrates the nature of suspended sediment transport in natural channels. Suspended sediment, unlike any other pollutant that is typically monitored, is entrained and deposited many times over throughout the course of a stormflow event. This results in large disparities in the relationships of both SSC concentration and turbidity experienced at different stations for different events. It is this variability that illustrates the need for high-frequency event sampling over a wide range of rainfall conditions and over a wide range of antecedent soil moisture conditions. Any grab sampling strategy at upstream/downstream stations would make the task of interpreting this variability even more difficult, if not impossible. Travel time considerations between stations and the problem of determining when to sample to best provide a meaningful comparison of the data confounds planning an effective grab sampling strategy. It is widely accepted by hydrologists in California that suspended sediment and turbidity monitoring has the best chance for success under controlled experimental conditions using accepted study designs.

The event-based data and the works published from the Caspar Creek studies and many other experimental studies have shown that impacts following land treatment can be successfully evaluated. Study design is key and both paired and nested (upstream/downstream) designs have been successful as long as calibration periods are adequate to have collected data that represent the range of conditions that will likely be experienced during the post-treatment period. These studies have produced volumes of papers evaluating pre- and post-harvest water quality conditions. New studies at Caspar Creek have been initiated to address potential impacts following harvests under more current practices. These studies will add to our current understanding of sediment-related effects, but these new studies are still in the calibration phase. There are no similar scientifically-defensible studies that have been completed in the coastal mountains south of Caspar Creek. Questions still remain on the potential for success further south in the coastal mountains where landslide-dominated watersheds experience more widely varying annual rainfall patterns.

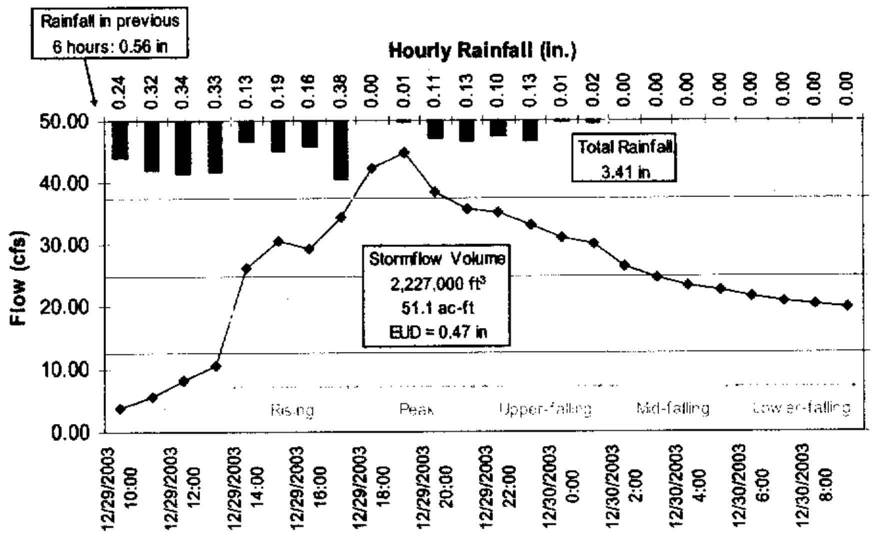
The Little Creek Study is one such study currently underway that incorporates a study design and instrumentation similar to Caspar Creek. The focus is also similar in that event-based suspended sediment and turbidity data is collected along with the associated hydrologic and climatic data necessary to determine sediment loads and quantify the hydrologic response. The study was originally designed to evaluate the effectiveness of harvest practices in protecting water quality from increases in suspended sediment following two harvests, the Lower Little Creek harvest and the North Fork harvest. With the Lower Little Creek harvest scheduled for this summer and difficulties in data collection during the start-up years along with two very dry years, the main emphasis of the Little Creek Study is now primarily associated with the North Fork harvest scheduled for 2006. Both paired and nested (upstream/downstream) study designs that use data from three stations, the North Fork, South Fork and Upper North Fork Stations, will be used to evaluate the North Fork harvest. The Lower Little Creek harvest is positioned between the Main Stem station and the confluence of the North and South Forks. Sampling and data collection will still continue at the Main Stem station as long as funding permits. The featured dataset represents the most comprehensive event-based suspended sediment and turbidity data in the region. Figures 1 through 4 and 5 through 8 summarize the suspended sediment, turbidity, and stormflow response for the December 29th - 30th and the January 1st - 2nd events, respectively. The turbidity, suspended sediment, and stormflow volume data is shown depicting four-hour blocks throughout the hydrograph to aid in making comparisons between stations and between events. The magnitude of rainfall for the 29th - 30th event was over an inch more than the 1st - 2nd event yet the stormflow volumes and peakflows were very similar between events for all stations. Greater magnitudes in the hydrologic response for the event on the 1st - 2nd did not translate into higher sediment loads. Pie chart depictions of the volume of stormflow for the four hour period surrounding the peak at each station illustrate this relationship. Using the North Fork and the Upper North Fork as an example, the load magnitude during the 29th - 30th event for the four-hour peak was 47,897 kg and 27,405 kg respectively. This represents a difference of 20,582 kg. During the 1st- 2nd event the load magnitudes for the two stations were 29,053 kg and 20,086, respectively. This represents a difference of only 8,967 kg for the latter, more hydrologically-responsive event. The increase in stormflow volume from the first to the second event can easily be explained by an increase in the hydrologic responsiveness due to higher antecedent soil moisture conditions, but the drop in the overall magnitude of sediment transported and the change in the relative differences between stations begins to add a great deal of complexity to the interpretation. The differences and the amount of variability are also evident in the summary graphs (Figures 9-14) that compare flow, turbidity and suspended sediment for each event at each of the four stations. These relationships vary for many of the reasons described earlier, but it also illustrates the need for high frequency monitoring over a wide range of climatic and hydrologic conditions. The ability to perform grab sampling at levels that would allow this variability to be described is highly improbable and can only detract from ground-based monitoring that will more assuredly and more quickly lead to corrective actions.

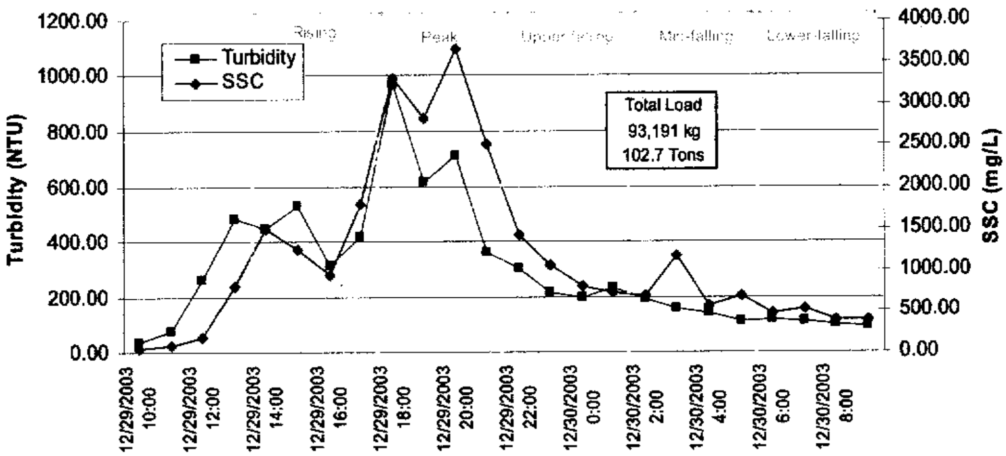
One last comment relates to the requirement to report one cubic yard of sediment released to a waterway. Another component of the Little Creek Study was to develop the Near-Stream Sediment Source Survey. A graduate student, Brooke Akers, developed the survey to document existing erosion features, namely eroding banks and smaller streamside landslides. In the lower Main Stem alone, over 50 features are present that have contributed approximately 100,000 ft^3 (3703 yd^3) of sediment. A feature is defined here as an erosion void greater that 200 ft^3 (7.4 yd^3) that appears to have been active within the previous three years. The linear distance of channel bank affected is over 2000 feet along approximately one mile of channel. Little Creek is typical of many tributary streams in the coastal mountains of the region and points to the need to reconsider the one cubic yard criteria.

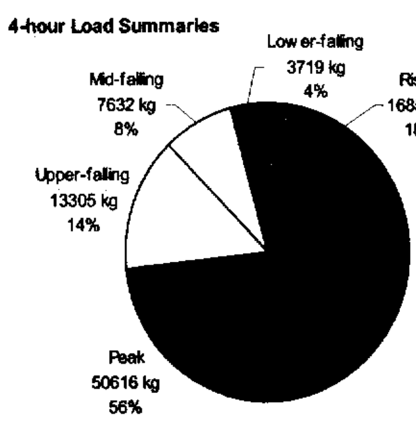
Sincerely,

Brian C. Dietterick, Ph.D., P.H.
Director, Swanton Pacific Ranch

Main Stem Flume - December 29-30, 2003







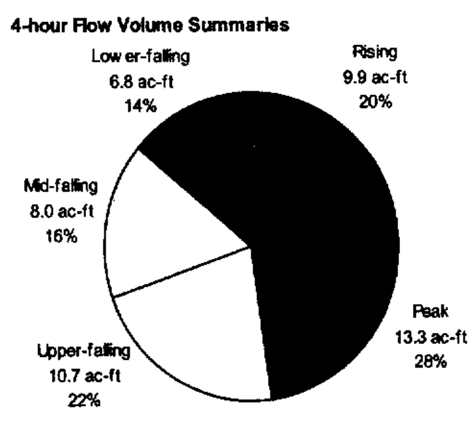


Figure 1: Event summary for December 29-30, 2003 at the Main Stem Flume station.

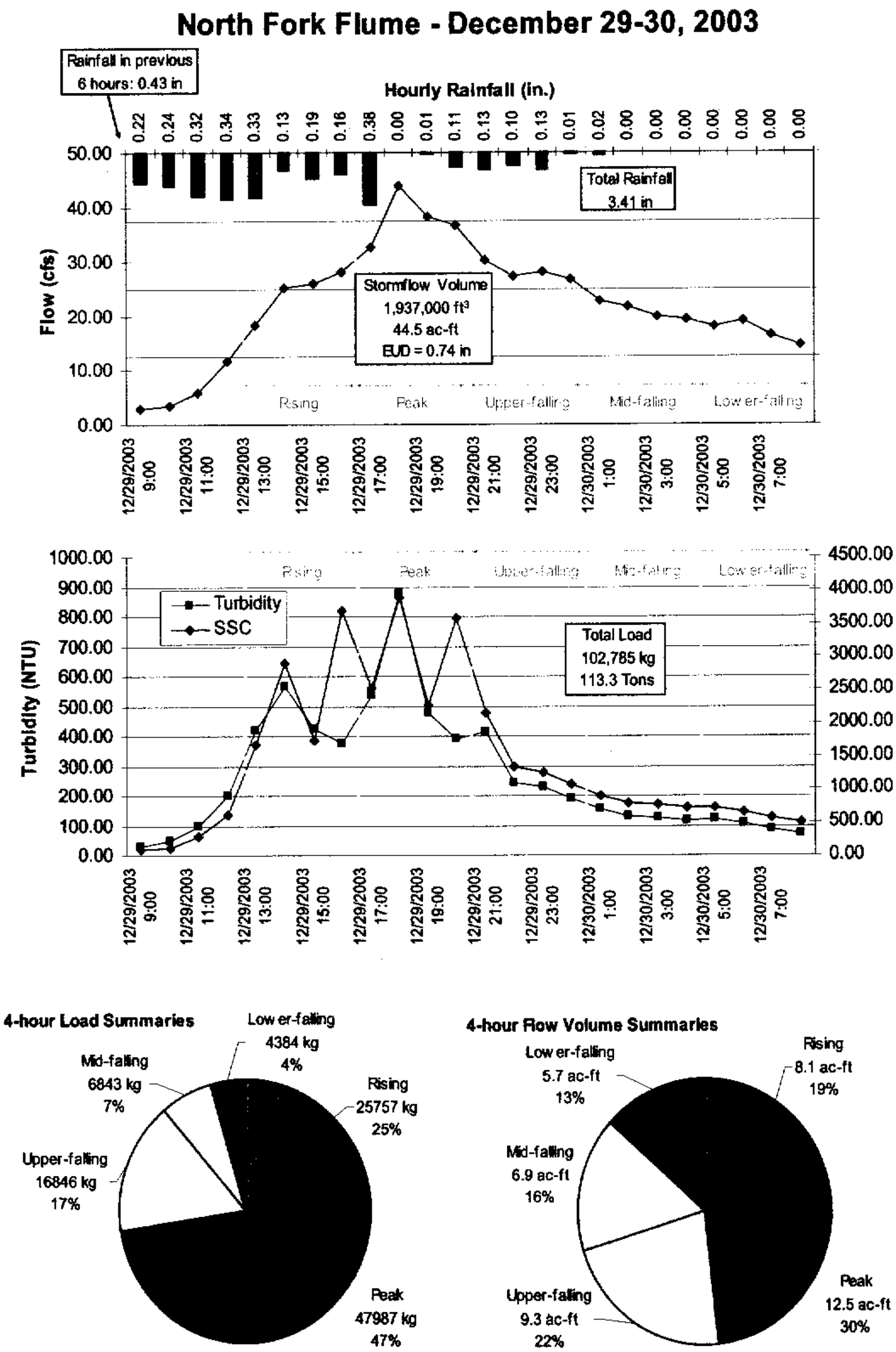


Figure 2: Event summary for December 29-30, 2003 at the North Fork Flume station.

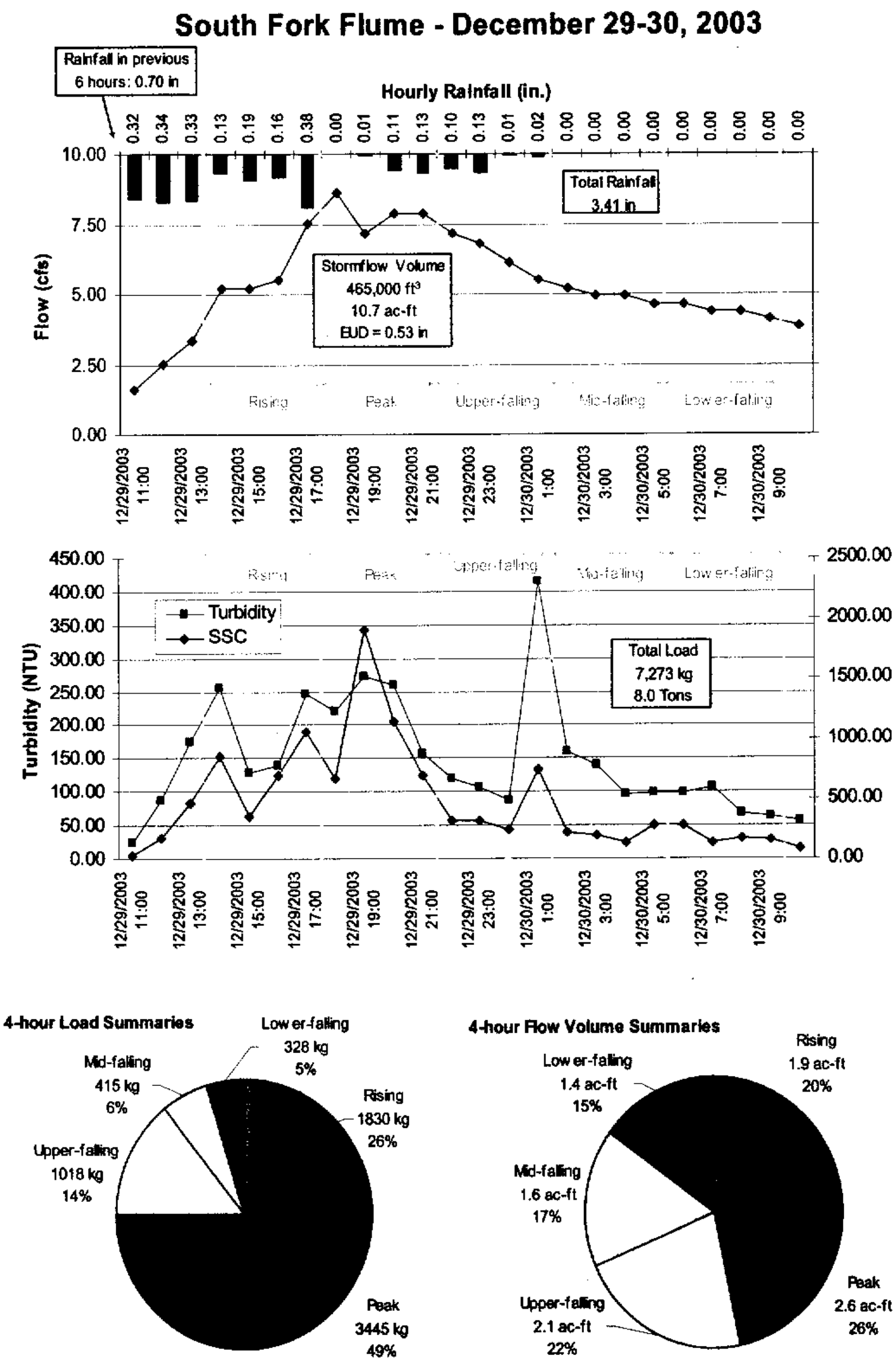


Figure 3: Event summary for December 29-30, 2003 at the South Fork Flume station.

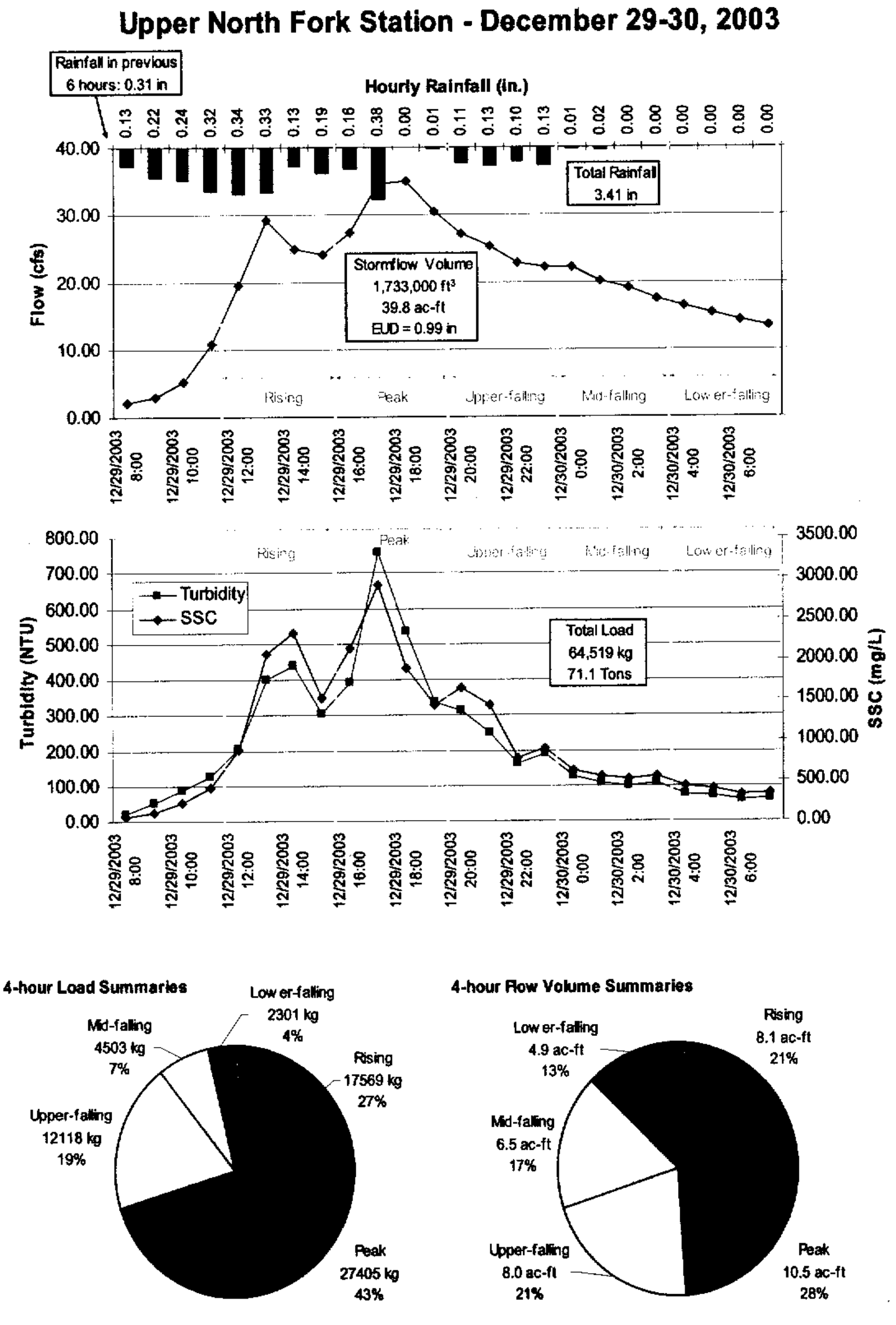


Figure 4: Event summary for December 29-30, 2003 at the Upper North Fork station.

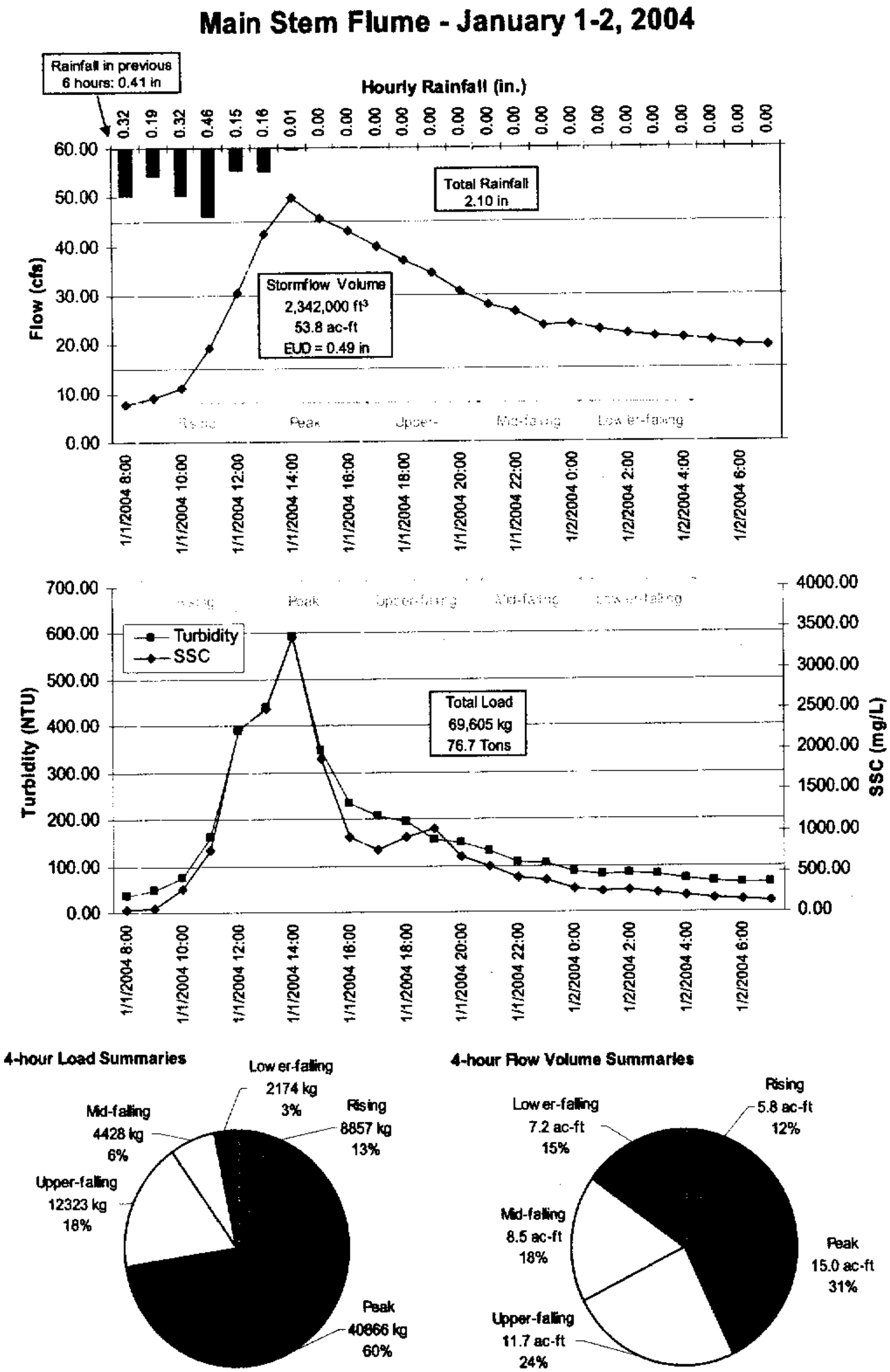


Figure 5: Event summary for January 1-2, 2004 at the Main Stem Flume station.

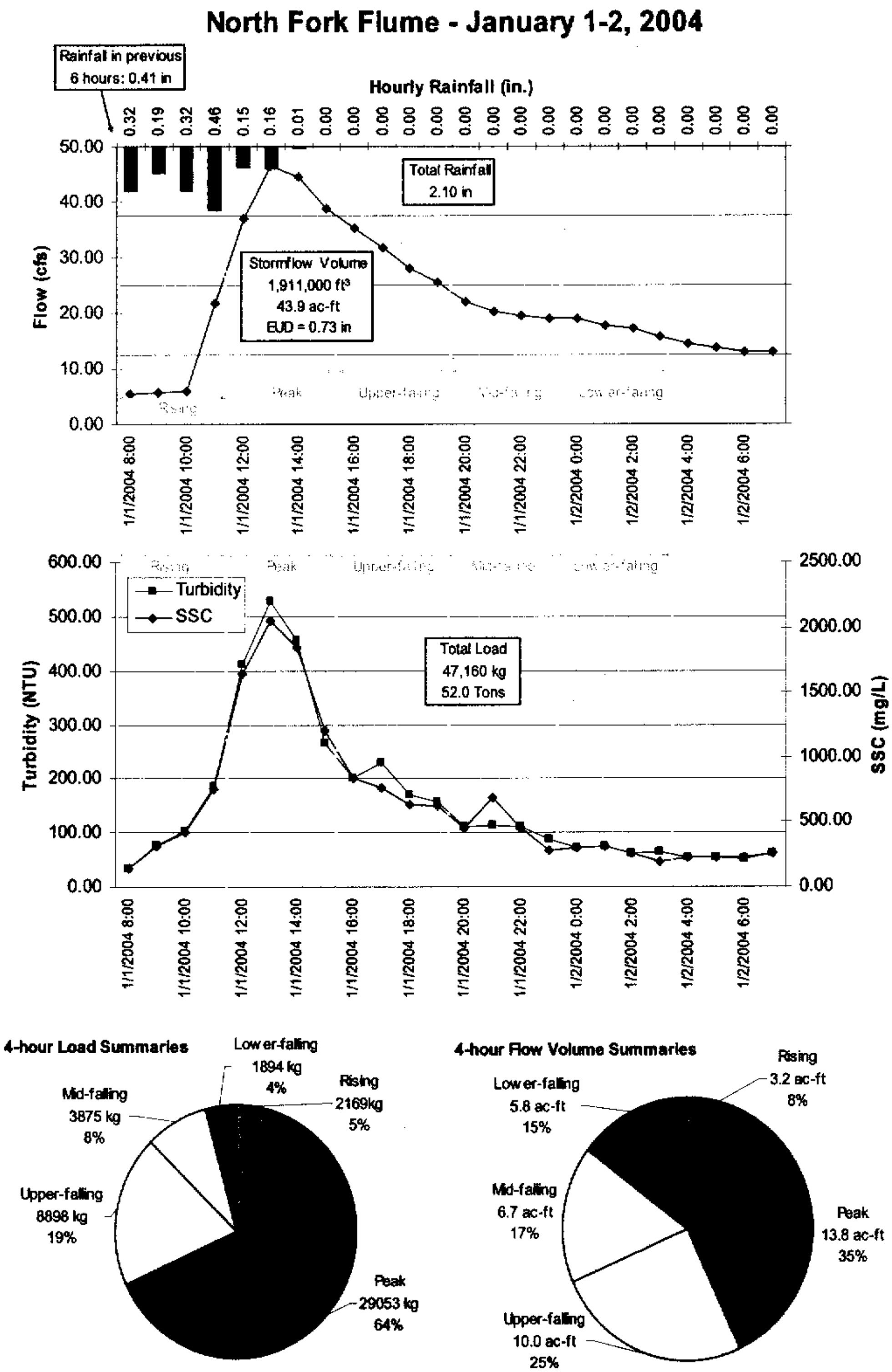


Figure 6: Event summary for January 1-2, 2004 at the North Fork Flume station.

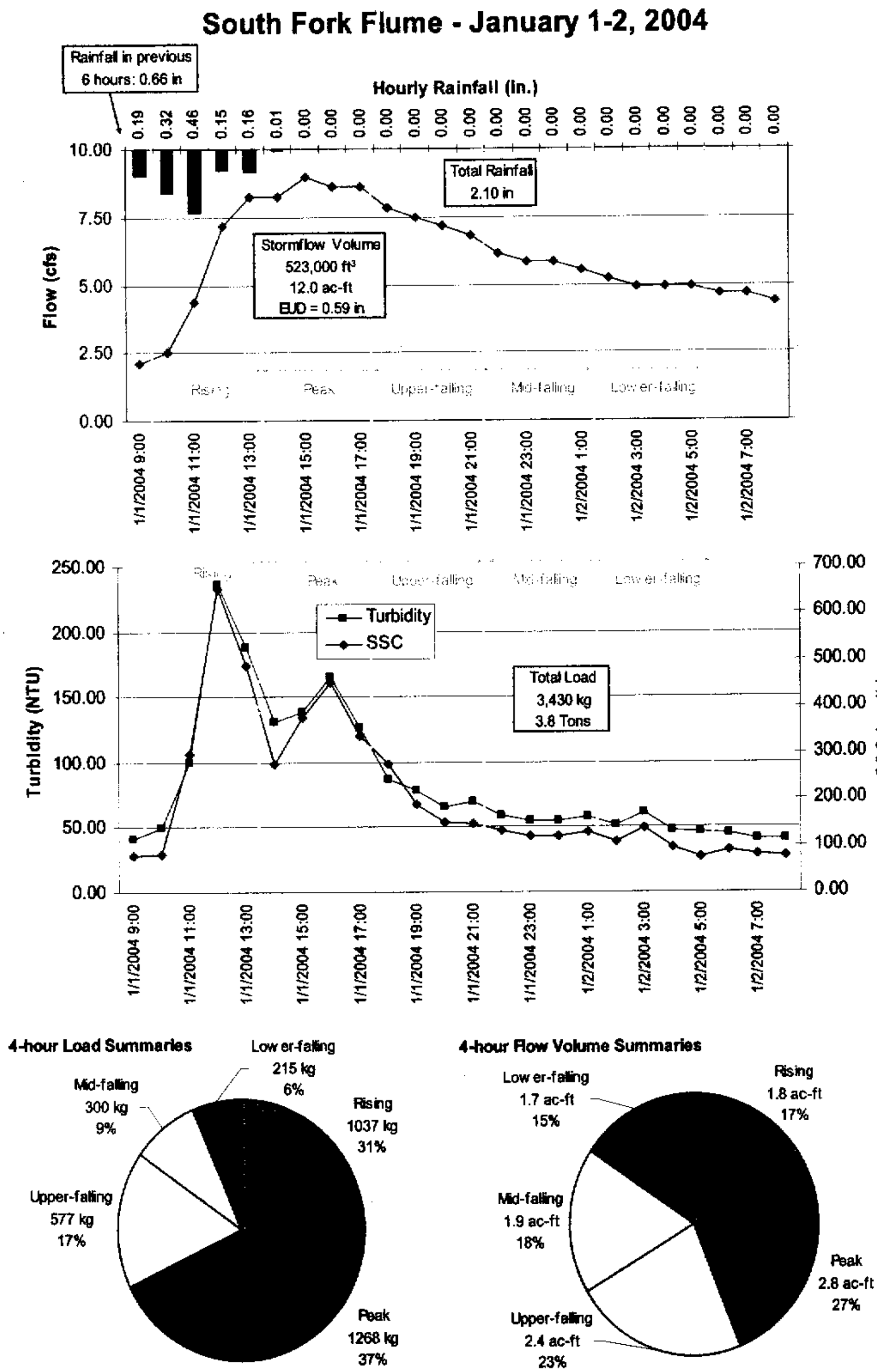


Figure 7: Event summary for January 1-2, 2004 at the South Fork Flume station.

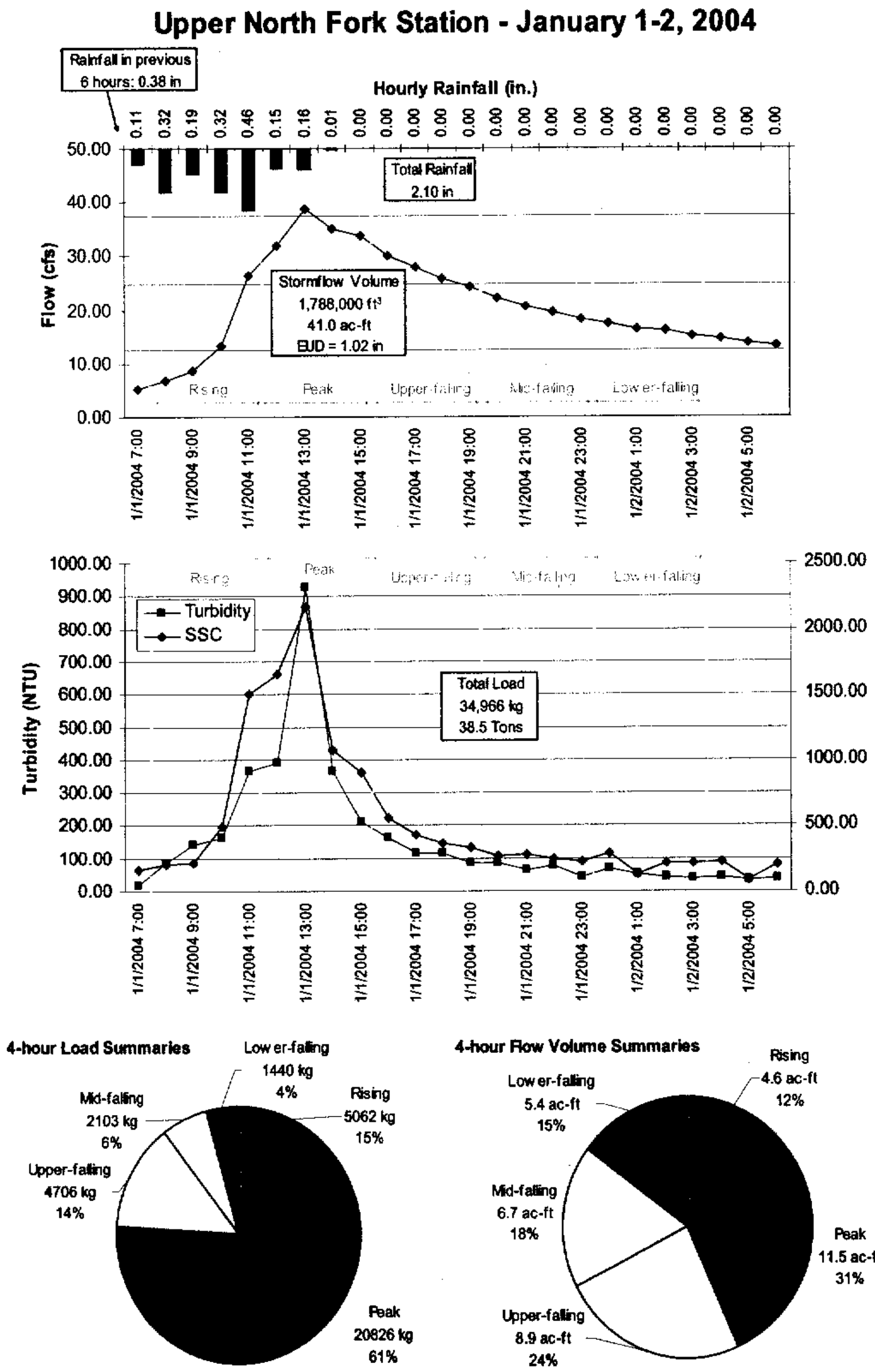


Figure 8: Event summary for January 1-2, 2004 at the Upper North Fork station.

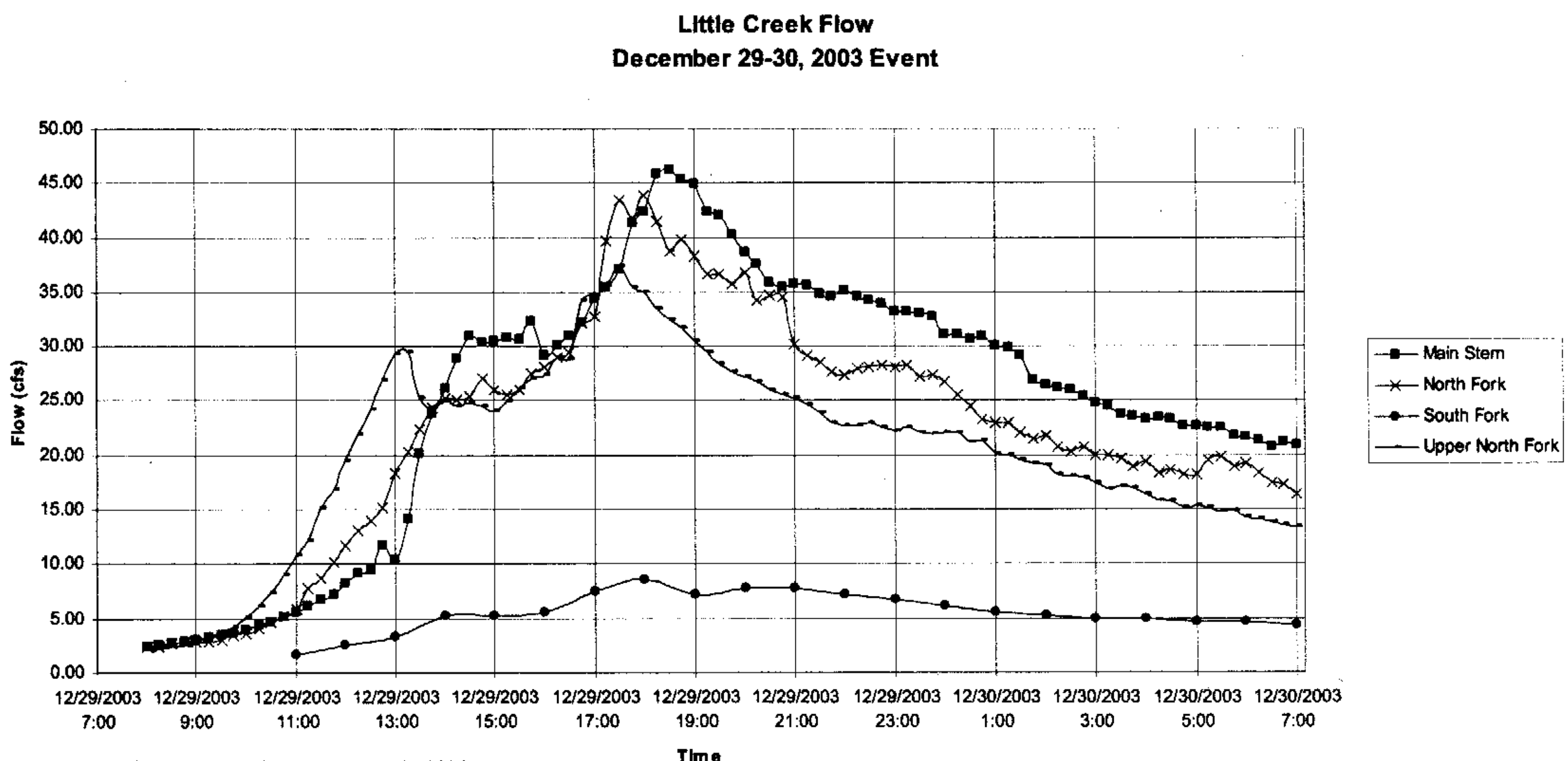


Figure 9: Flow Summary for December 29-30, 2003

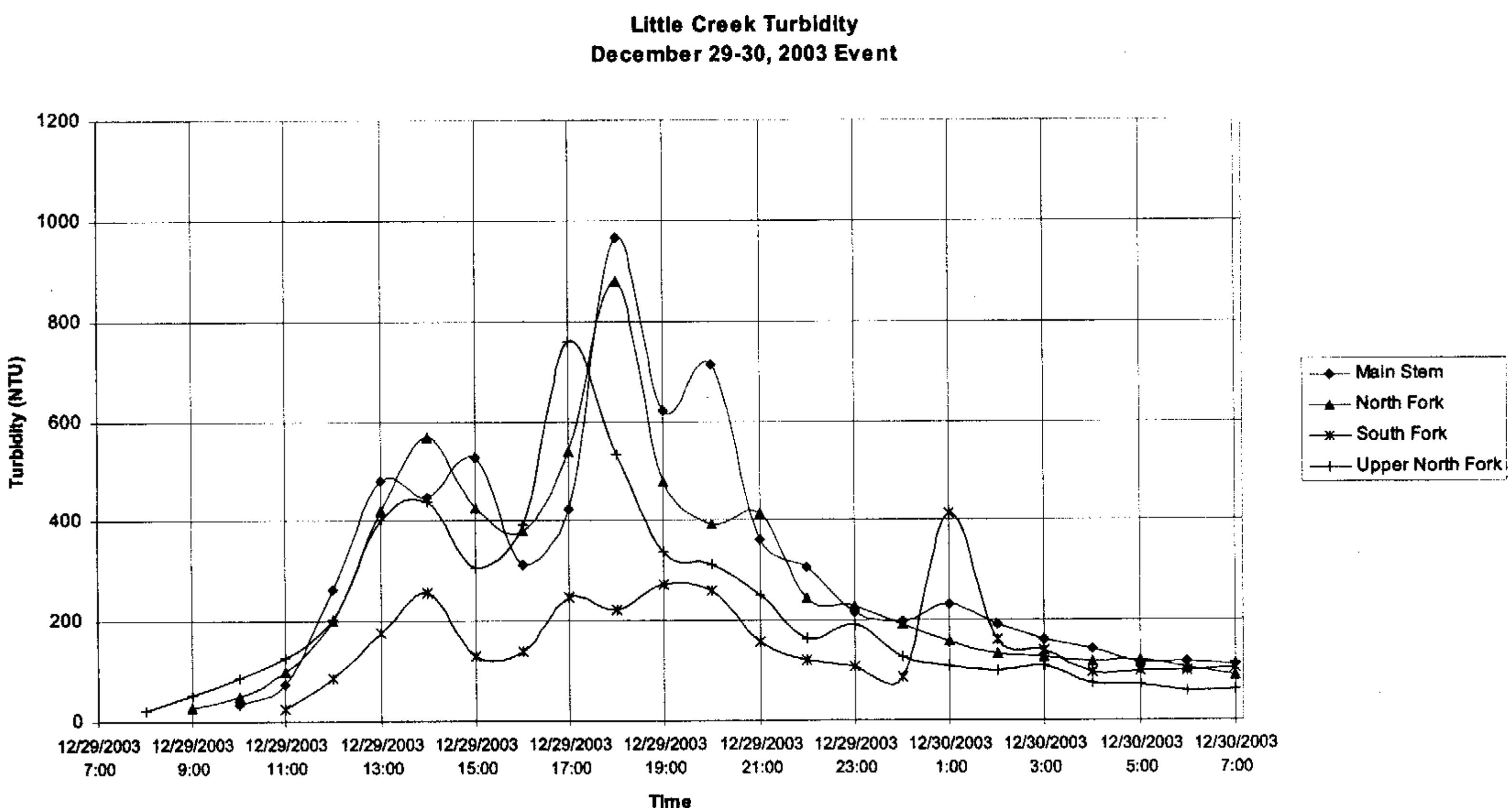


Figure 10: Turbidity Summary for December 29-30, 2003

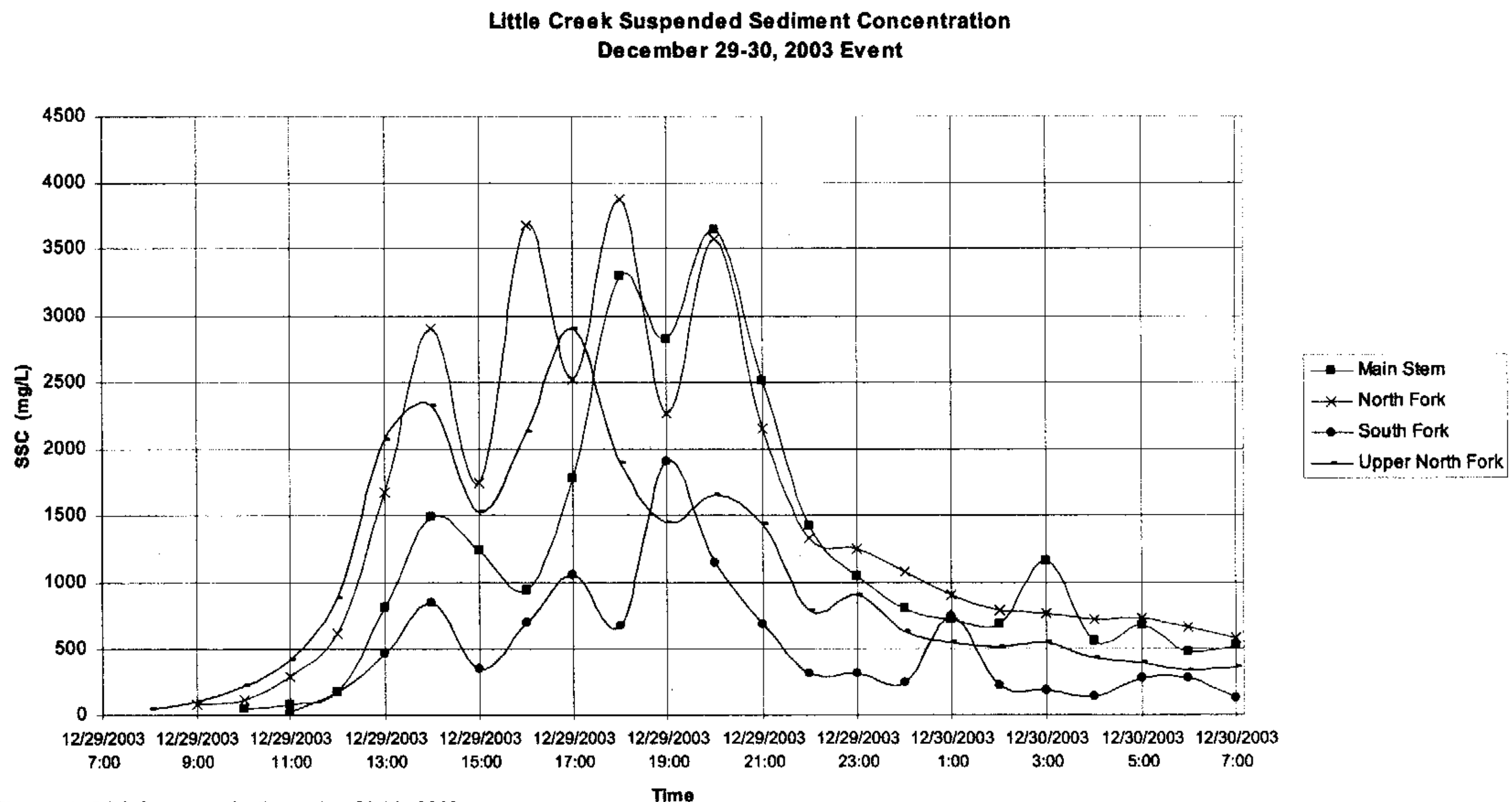


Figure 11: SSC Summary for December 29-30, 2003

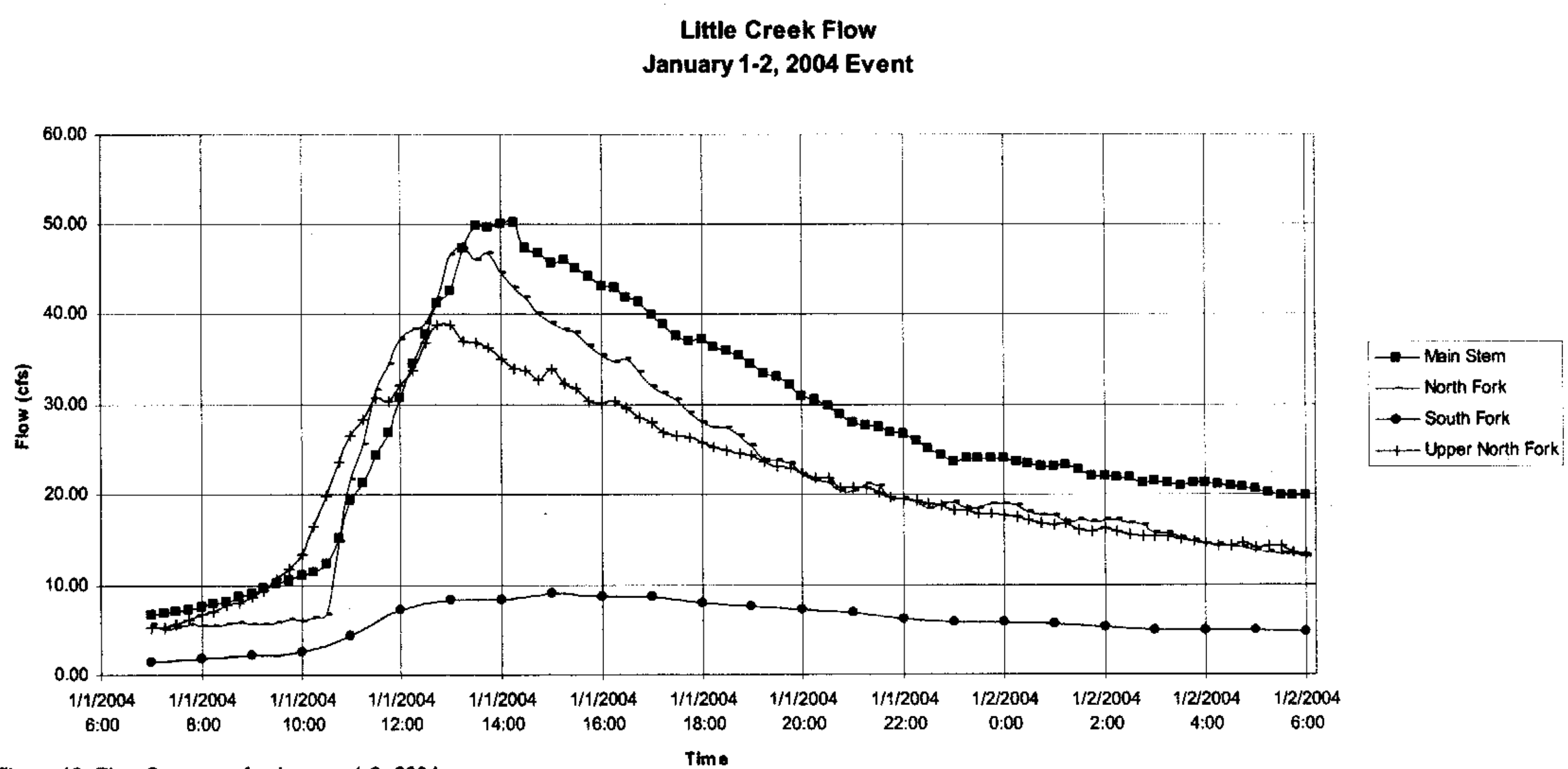


Figure 12: Flow Summary for January 1-2, 2004

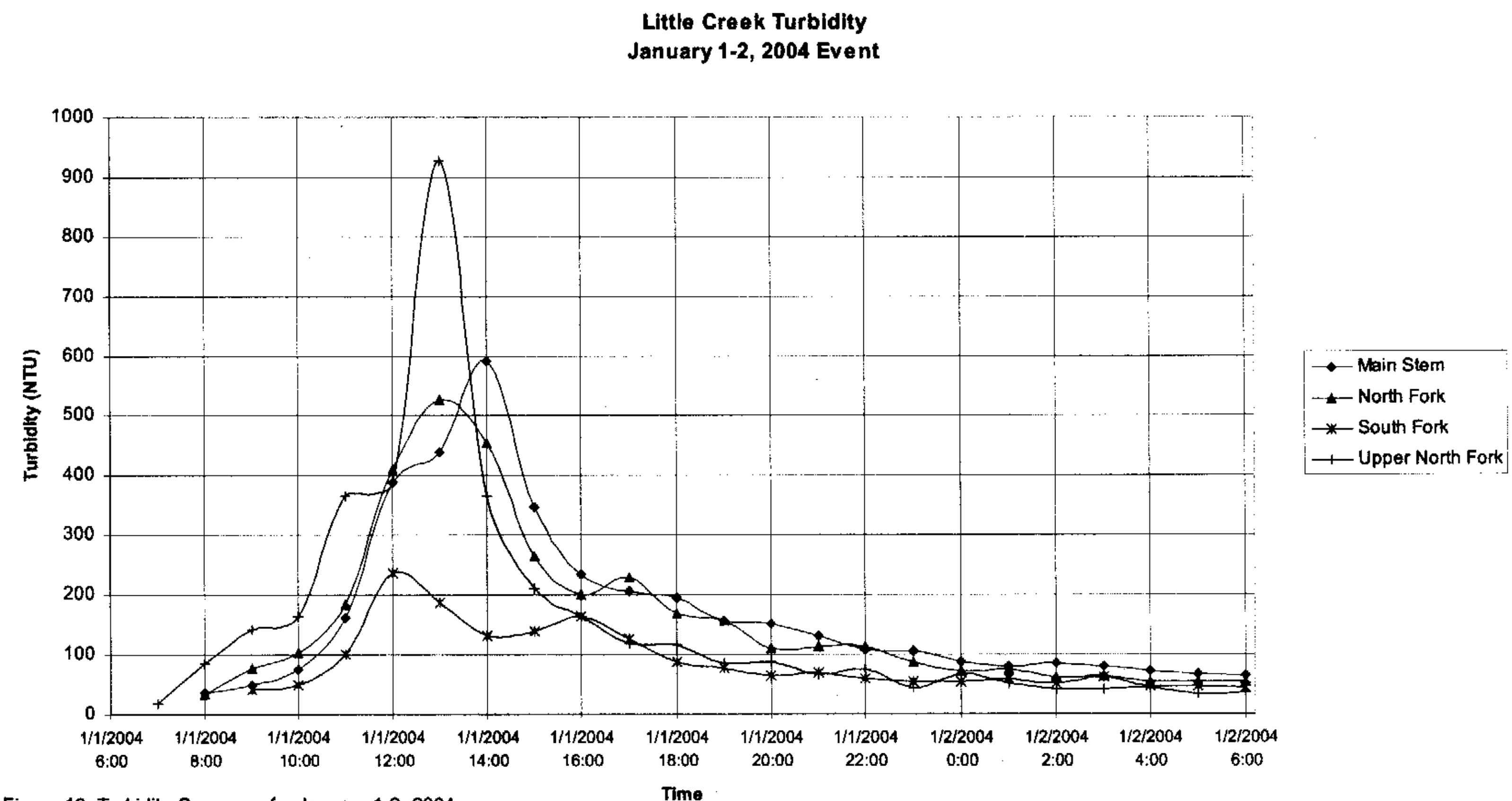


Figure 13: Turbidity Summary for January 1-2, 2004

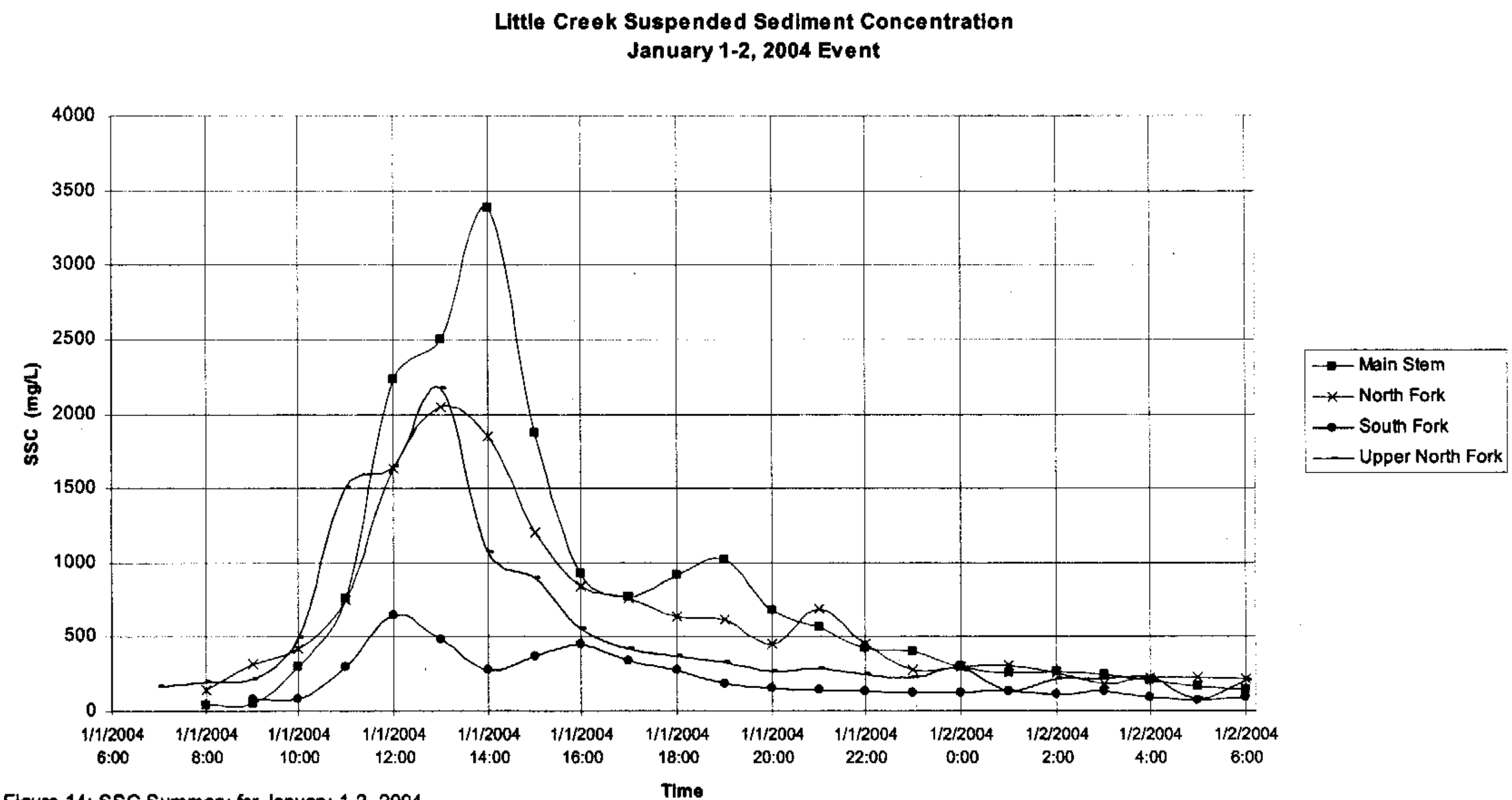


Figure 14: SSC Summary for January 1-2, 2004